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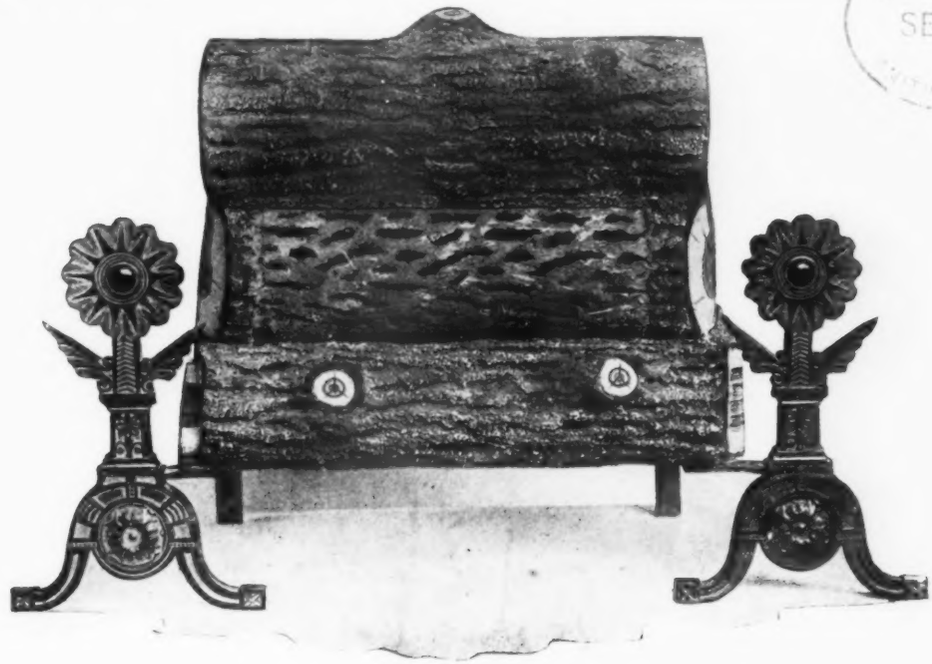

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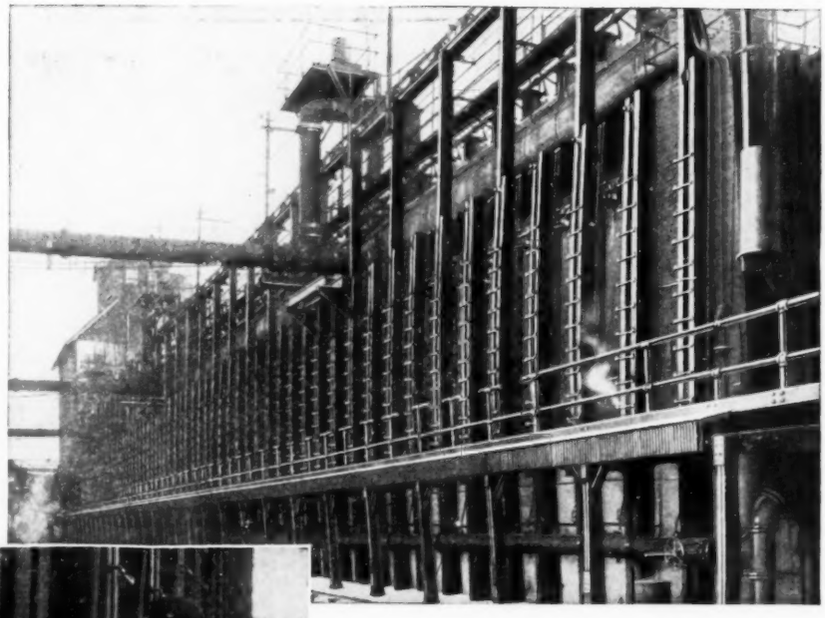

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Experimental Comparison of a Preheated Air Furnace With a Direct Fired Furnace

What Is Shown by Many Months of Laborious Work

By O. LELLEP, Metallurgical Engineer

There are many conflicting statements on the merits of recuperative furnaces, or furnaces using preheated air to save fuel. There are enthusiasts of these furnaces and there are skeptics The construction of industrial furnaces has been heretofore done on a rule and thumb basis, and only in recent times the rational scientific method is finding some adherents. There are few reliable data on furnace performances and different manufacturers' catalogues claim economies which might be true, but which, however, do not give the full truth Undoubtedly, good results have been obtained from recuperative furnaces, and large percentages of saving are obtained in comparison with direct fired furnaces

These claimed savings differ greatly and the difference can be simply explained by the fact that the comparison between a recuperative furnace and a direct-fired furnace has not been always made on a fair basis. If the direct-fired furnace was poorly built, for instance, without insulation and with inefficient burners and the recuperative furnace was, on the contrary, better designed, was well insulated, and the burners applied correctly, the great percentage of saving was not due to the recuperation but to the improvement in general design of the furnace.

The question whether it pays to preheat air in city gas-fired industrial furnaces has long been under controversy. But the discussion has been of little value so long as comparative and impartial test data have been lacking. Considerable time and expense were involved in obtaining the information contained in this article. We consider it of immense value to the industry.—Editor.

An investigation was started with the object to compare experimentally the two types of furnaces under similar conditions, and in this way, to obtain directly comparable results. A simply constructed gas-fired furnace was chosen. It was equipped with necessary burner equipment and the heat recuperator, or air preheater. For a period, the furnace was operated with preheater until stable heat equilibrium in furnace walls was obtained. Then, the same furnace was operated with directly fired burners and cold air. The gas consumption in both cases was checked carefully and gave the required basic data Three experimental runs were made; one at 1,130 deg. Fahr., another at 1,800, the third at 2,230.

Testing Equipment

The furnace and the recuperator together with necessary burner equipment is shown on the sketch (Fig. 1). The furnace itself, was four feet long, two feet wide and two feet high inside. It was built with four-an-one-half-inch-thick fire brick walls without insulation. The recuperator was made of a standard steam heat radiator having a heat transmission surface of twenty square feet. Cast-iron plugs were used between certain connections to direct the stream of air in the radiator in zigzag way. To mix gas and air in proper way and to burn the explosive mixture, a regular proportioning inspirator and burner were used together with a corresponding gas governor. The object of the inspirator and gas governor which reduced the gas pressure to atmospheric pressure independently of the street pressure was to keep the air and gas always in correct theoretical proportion. It seems not necessary to go into details of this proportioning device. The burner consisted of a heavy cast-iron casting. The burner orifice was chosen smaller for lower temperatures, and larger for higher, and varied from ¾-in. diameter to 1¼-in.

To be able to run the furnace with cold air, provision was made for an air connection directly to the inspirator without going through the air preheater. All the exposed piping, including inspirator, were insulated with one-inch-thick asbestos covering. The duct or channel connecting the furnace to the recuperator had an opening to the outside which was kept closed when the recuperator was used and open when the furnace was run with cold air. In the last case, the opening on the right-hand end of the recuperator was closed so that all the flue gases had to come out through the opening in the connecting duct.

The brick wall around the recuperator consisted of four-and-a-half-inch fire brick, and one-inch voids were left between the recuperator and the inside wall.

All the furnace equipment was not designed to reach any particularly low gas consumption. The primary object was to determine the comparative gas consumption with and without recuperation in a furnace of simplest construction. Gas was measured by a sixty-light gas meter which had been tested by New York Consolidated Gas Company. The meter was placed sufficiently far not to be influenced by the hot radiation from the furnace.

A correct proportioning of gas and air in the furnace has a marked influence on the gas consumption, the lowest consumption being obtained with theoretical mixture. Therefore, it was important to have means to check the correct proportion. This was done with an Orsat apparatus and afterwards with a combustion indicator. During correct proportioning the gas analysis showed practically no oxygen and no carbonmonoxide or only insignificant amounts of these gases. The combustion indicator is shown on sketch (Fig. 2). It consists of a small burner made of metal and lined with refractory cement. The lower part of it is filled with refractory granules, three-sixteenths inch large. Gas and air mixture is supplied through small holes in the bottom, and this explosive mixture burns in the voids between the incandescent granules instantaneously and perfectly.

The products of complete combustion leave the burner through opening on the side of the casing. If a mixture with some excess air is supplied, there is no visible flame issuing through this side opening but as soon as the mixture contains some excess gas, a blue haze or flame is issuing from this opening. This difference can be observed very distinctly in a dark room but not sufficiently sharp in sunshine. Therefore, another indicator was used in connection with this burner. It consisted simply of a piece of quarter-inch pure uncoated copper wire put upon the refractory bed through the side opening. If the hot gases contain some excess air copper is oxidized and its surface is coated with oxide. Indications are sensitive if the temperature of copper is kept between 1,200 and ,400 deg. Fahr. But as soon as the flue gases contain some small percentage of carbonmonoxide, this oxide coating is reduced in some seconds, if it is not very thick. The appearance and disappearance of oxide coating can be readily distinguished when the flame is reducing and the rod is taken out of the indicator into air and then put back again. The sensitiveness of this combustion indicator if handled correctly is approaching to the sensitiveness of an Orset apparatus. Its advantages for determining the correctness of air and gas proportionately are easiness of observation and quickness of results.

The following temperatures were measured: (a) Of the furnace; (b) of the hot air coming into the burner; (c) of the mixture before the burner; (d) of the burner tip; (e) of the gases leaving the recuperator.

In corresponding places, base metal unprotected thermo-couples were used, and for the higher furnace temperatures, a platinum thermo-couple. The indications on the galvonometer were checked by determining the melting point of lead simultaneously with all couples placed into a pot filled with this metal. An arrangement was made to use only one indicator for all the base metal couples and one for platinum couple by switching over the necessary connections.

Method of Taking the Gas Consumption

Suppose the gas consumptions with and without preheated air for the furnace temperature of 1,400 deg. were desired. The cold furnace was started using the preheater. Gradually the temperature came up and the gas consumption sank. First, it was hoped to obtain so-called holding consumptions after three to four hours of heating the furnace. This proved to be an error. A satisfactory constant gas consumption was reached only after ten hours of heating, or still better, after twenty-four hours, and all later tests were made after this long-time heating. Under holding condition, it is understood this period, when the furnace is soaked with the heat, so that all the heat which is absorbed by the internal surface of the furnace is lost by the outside surface of the furnace walls, and no more heat is absorbed by the furnace walls themselves.

To know that the holding consumption was reached the gas consumption as indicated by the rotating handle of the gas meter was determined from time to time. When the temperature and the amount of gas consumed remained reasonably constant for many hours, the holding condition was reached. During each reading of the gas meter a corresponding determination of other variables of the tempertures and of the air, gas and burner pressures were made. In this way, the gas consumption was determined for the furnace using preheated air. Then the air connection to the inspirator was changed over to the cold air supply, and the flue gases taken out through the opening in the connecting duct to the recuperator. During this changing over from hot air to cold air, the furnace temperature sank a little, and it took from half an hour to about one hour to reach previous temperature conditions in the furnace. Then again the gas consumption the different temperatures, the burner gas and air pressures and the correctness of proportioning were observed. These observations were written on a log paper as shown hereby for one test (see table 1).

Difficulties Encountered

So simple as it seems, actually it is not so easy to determine in a reliable way, the holding gas consumption of a furnace. This holding consumption is depending upon many conditions which are not easily controlled. For instance: if the furnace is erected in open air, the atmospheric conditions have some influence. In windy weather, the cooling of the furnace from outside is more pronounced than in still weather. In cold weather the consumption must be slightly more than for warm weather. The holding consumption is also dependent upon the heat value of the gas used. Even the atmospheric pressure by compressing more or less the gas used must change the holding consumption. Not all of these disturbing influences could be eliminated, and many of the first observations did not check over with each other. As the object was to find out the saving of gas consumption, in the same furnace, with preheated air, as compared with gas consumption, using cold air, and this saving of gas is the difference of these two consumptions, any of the observation errors, or the disturbing influences is magnified many times in this difference of the two observations. Undoubtedly the methods used and accuracy of the results obtained can be im-

Table 1

TEST OF EFFECT OF PREHEAT
1. ON GAS CONSUMPTION OF FURNACE
2. ON STANDARD BURNER

DATE Jan. 6 to Jan 7 1920

GAS USED N.Y. CITY. 650 B.T.U.

TEST NO 6 FURNACE TEMP 2290°F PREHEAT AIR 890 °F MIXTURE 670 °F

ATMOSPHERIC TEMP 20 °E BAROMETER 760 mm WEATHER fair

BURNER ORIFICE 1/4" DIA. INSPIRATOR THROAT 0.8" DIA. gas NOZZLE 0.45" DIA.

TIME	PRESSURE H_2O BURNER	COLD AIR	HOT AIR	GAS	METER READ METER READINGS	TIME FOR CU.FT. GAS	CU. FT. GAS PER HOUR	TEMPERATURES FURNACE	MIXTURE	AIR	BURNER TIP	BURNER SHANK	FLUE GAS LEAVING	COLD JUNCTION	FLUE GAS ANALYSIS CO_2	O_2	CO	REMARKS
1.30pm	7.0	14.5		0														furnace lit up
5.00	7.0	14.6		"				2300										
6.55	4.8	9.7		"	1780			2250	650	870	1165		480	73				
8.25	4.0	8.2		"	1837			2255	670	910	1210		480	72				
10.00	4.4	9.		"	1889			2225	670	890	1230		460	79				
12.30AM	4.8	9.5		"	1956			2220	670	915	1260		475	78				
2.00	5.0	9.8		"	2005			"	685	920	1260		485	76				
3.00	5.0	9.9		"	2022			2225	680	910	1260		470	80				
5.00	5.3	10.6		"	2082			2270			840			67				
6.30	4.8	9.7		"	2136			2300			860			69				
8.00	4.8	9.7		"	2188			2240			880			70				
9.00	3.5	7.1		"	2218		334	2200			880			69				furnace run
9.30	4.6	9.3		"				"			870			80				with cold air
12.00pm	4.3	8.7		"	2326			2240			850			81				
1.25	4.3	8.7		"	2367			2230			850							
2.25	5.3	10.8		"	2393			2220	700	945	1100		520	90				
3.15	6.2	12.0		"	2414			"	670	900	1130		456	91				
4.45	6.2	12.0		"	2454			2200	670	890	1140		450	87				furnace run
5.50	6.8	13.9		"			264	"	"	"	1140		450	86				with preheated air
7.30	6.6	13.3		"	2530			2260	675	910	1160		470	90				
9.00	6.2	12.0		"	2571			2230	645	880	1160		450	90				
10.00	6.3	12.1		"	2593			2225	680	890	1190		460	85				

Slightly less than cold air

Indicates almost correct mixture of gas and air

TEST CONDUCTED BY O. L. Alip ASSISTED BY Shoemeyer

proved considerably. Desirable scientific precision had to be compromised to save time.

The Results Obtained

The most essential part of all the observations made, is summarized in table 2. It might look surprising that the temperature of the preheated air never approached the furnace temperature. If the brick wall enclosing the recuperator would be impenetrable for heat and the heat exchange in the recuperator body itself perfect, the incoming air should reach the temperature of the waste gases or the furnace temperature. The ideal condition is well imaginable because the heat content of the waste gases is always higher than the heat content of air at the same temperature.

Table 2—Experimental Gas Consumption Data With and Without Recuperation

	Test No. 1	Test No. 4	Test No. 6
Furnace temperature, deg. Fahr.	1,430	1,800	2,230
Gas consumption with cold air—cubic feet per hour	146	200	334
With preheated air—			
Temperature of preheated air —degrees Fahrenheit	350	710	890
Gas consumption—cubic feet per hour	136	172	264
Per cent saving against direct fired	6.85	14	21

Actually we see that the air temperature after passing the recuperator was only 350 deg., while we should expect 1430 deg. This fact can be explained by the heat losses, through the outside walls of the recuperator, by leakage and by the imperfectness of heat exchanged in the recuperator. As it can be seen from table 2, the temperature of preheated air at higher furnace temperatures is higher in percentage than at the low temperature of the furnace. This is fully explainable by the following consideration:

On diagram (fig. 3) the heat content of products of combustion resulting from burning one cubic foot of 507 B.t.u. gas has been figured out. The ready diagram of Professor Thom. G. Estep, as published in Professor Trinks' instructive article on furnaces, has been used. This diagram refers to a 507 B.t.u. coke oven gas instead of 600 B.t.u. New York City gas. However, the difference in calorific value does not influence to any extent the relative percentage of available heat in both gases. Five hundred and seven B.t.u. gas as basis has been used for theoretical computations, as this gas approaches more to the lowered B.t.u. standard of an average city gas. At about 3,800 deg. Fahr., the products contain 507 B.t.u. This temperature is the calorific intensity or also so-called theoretical flame temperature. If the products are cooled down to a certain temperature a determined amount of heat is liberated and absorbed by the surroundings, or by the furnace.

For instance, the products of combustion contain at 1,430 deg. Fahr. only 157 B.t.u. That means burning gas in a furnace at 1,430 deg. Fahr. 570 minus 157 equals 350 B.t.u. have been left in the furnace: 350 B.t.u. is the available heat of gas at the furnace temperature of 1,430 deg. Fahr. For a rational understanding of industrial furnaces, the conception available heat is all important. Because, only the available heat is actually heating and utilized in furnaces, while the heat in products of combustion at the furnace temperature cannot be utilized at all in the furnace and is wasted in all the direct-fired furnaces. The heat in waste gases plus the available heat utilized in furnace total 507 B.t.u. for one cubic foot of gas. In a direct-fired furnace where the products of combustion cooled down to 1,430 deg. Fahr., the available heat utilized for heating the furnace is 350 B.t.u. per cubic foot or $350/507 \times 100 = 69$ per cent of total heat, and the waste heat equals 31 per cent.

This percentage of utilization can be still called reasonable. Quite different is the situation for a direct-fired furnace working at 2,800 deg. Fahr. The waste heat which is thrown away in the furnace at this temperature is 330 B.t.u., or $330/507 \times 100 = 65$ per cent, and only 35 per cent or 177 B.t.u. can be utilized at best. It is plain from the diagram that in the direct-fired heating devices working at lower temperatures, most of the heat can be utilized while in very high temperature furnaces, if fired directly, most of the heat has to be thrown away into the flue.

This somewhat long explanation seemed necessary to show why at low temperatures of the furnace the preheating effect is insignificant.

	Deg. Fahr.	Deg. Fahr.	Deg. Fahr.
Furnace temperature	1,430	1,800	2,230
Per cent of available heat	69	60.5	50
Per cent of waste heat	31	39.5	50

At 1,430 deg. Fahr. the waste heat is less than 1/3 of the total. This small amount of heat has to cover the heat lost through the outside walls of the recuperator. This loss, for a small city gas furnace is relatively considerable.

Some heat remains in waste gases after they leave the recuperator. It is plain, therefore, that very little is left over for preheating the air, the temperature of which could be raised actually only to 350 deg. Fahr.

Much more favorable were the conditions for preheating air at a furnace temperature of 2,240 deg. Fahr. In a direct-fired furnace at this temperature, one-half of the heat is thrown away or is wasted in the waste gases. This large amount of heat can cover different losses in the recuperator, and still a considerable amount is left over to preheat the air, the temperature of which was raised to 890 deg. Fahr.

One source of heat losses in a recuperator furnace is the unavoidable leakage of gases in all practical furnaces. In many heat treatment furnaces the door has to be opened often during working hours, and in the forge furnaces the working slot remains almost always open. The waste gases following the least resistance stream out of the door and only partly enter into the recuperator. Some constructors place the recuperator above the door opening. But cold air drawn through the recuperator, together with the hot waste gases lowers the efficiency of the recuperator, so that the temperature of preheated air is often below 200 deg. Fahr. and the complicated re-

cuperator arrangement practically useless, or of negligible value.

If the furnace and recuperator casing are absolutely tight, only then, all the waste gases are going through the recuperator. But this ideal condition is never realized in practice. In case the furnace walls are made of brick, without metal casing, like in the experimental furnace used and all the visible crevices and voids closed up, just the same a considerable part of the hot waste gases escapes through the invisible voids in brick wall. According to some indications, the amount of gases escaping in this way was estimated at 25 per cent of all the products of combustion.

A further source of heat losses, in recuperator enameling furnaces, for instance, is the loss of heat in piping from the recuperator to the burners, if the recuperator is placed on the top of the furnace and the burners at the bottom. It is true that this loss can be minimized by insulation which, however, is not always applied.

As seen from the table, the saving of gas due to recuperation was only 6.85 per cent at 1,430 deg Fahr., 14 per cent at 1,800 deg., and 21 per cent at 2,230 deg. Fahr. The saving is dependent from the temperature of preheat, which again depends from the type of furnace used, its size, design and the amount of leakage. For instance, higher percentage of saving is probable and possible, if the size of furnace is large and consequently the cooling effect of outside walls of the recuperator is much smaller. Better preheating would have been obtained also if the recuperator had been located on top of the furnace. The sketched design and location of the recuperator was chosen for the sake of simplicity of construction.

The size of experimental furnace was taken to correspond about to an average city gas-fired furnace. This gas, as an expensive, but very efficient and comfortable, fuel is more profitable in smaller heating units than other cheaper but less perfect fuels. It looks safe to say, that an average city gas furnace consumes less than 500 cu. ft. per hour, and most of them less than 200 cu. ft. A furnace consuming 6,000 cu. ft of city gas per hour would possibly give as high preheat temperature as 1,000 deg. Fahr. but these extreme sizes are practically out of the question for city gas.

Three hundred and fifty degrees as temperature of preheat was obtained when 80 per cent of all the furnace gases were directed into the recuperator. In actual average practice that is hardly possible, and therefore the saving should remain below 6.85 per cent. This saving is apparently more than offset by the cost and maintenance of the recuperator.

At 1,800 deg. Fahr. and 2,230 deg. Fahr. the saving of gas was 14 per cent and 21 per cent respectively.

Table 3—Theoretical Computation of Fuel Saving Due to Preheated Air, Compared with Fuel Consumption in a Direct-Fired Furnace

Furnace temperaaure—deg. Fahr.	— 1,400 —		— 1,800 —		— 2,200 —		— 2,600 —		— 2,800 —	
Available heat of gas burned with cold air in B.t.u. per cubic foot....	357		307		257		200		172	
Temperature of preheated air, deg. Fahr.	B.t.u. in preheated air to burn 1 cu. ft. of gas.	Available heat of gas burned with preheated air in B.t.u. per 1 cu. ft. of gas.	Per cent of saving.	Available heat of gas burned with preheated air in B.t.u. per 1 cu. ft. of gas.	Per cent of saving.	Available heat of gas burned with preheated air in B.t.u. per 1 cu. ft. of gas.	Per cent of saving.	Available heat of gas burned with preheated air in B.t.u. per 1 cu. ft. of gas.	Per cent of saving.	Available heat of gas burned with preheated air in B.t.u. per 1 cu. ft. of gas.	Per cent of saving.
400	30	387	7.75	337	8.9	287	10.5	230	12	202	14.8
800	60	417	14.4	367	16.3	317	18.9	260	23.1	232	25.8
1,200	90	447	20.1	397	22.6	347	25.9	290	31	262	34.3
1,600	125	...	.....	432	29.0	382	32.5	325	38.4	297	42
2,000	164	...	.....	...	....	421	39	364	45	336	48.7
2,400	205	...	.....	...	...	...	....	405	50.6	377	54.4
2,800	246	...	.....	...	....	...	....	...	....	418	58.8

Again these savings can be hardly realized in actual practice, due to the circumstances pointed out previously.

There is one parallel in the construction of the steam engine and industrial furnaces. Technically sound improvements are not economically paying propositions in small units. It would be an unpardonable waste to construct a modern steam engine of 6,000 h.p. without using superheated steam and condensation, while hardly anybody is considering these improvements for a five horse-power engine. Recuperation is economically justified for a large furnace consuming 6,000 cu. ft. of gas per hr., but it would be an error to use it for a hardening furnace consuming 60 cu. ft. per hour.

Materials Used for Construction of the Recuperators

At higher recuperator temperatures, another serious obstacle has to be taken into consideration. That is the lack of a suitable material for the recuperator. The temperature of air in recuperator tubes must remain always considerably lower than the temperature of the recueprator tubes. At air temperatures of 890 deg. Fahr. the hottest part of recuperator was around

1,100 to 1,200 deg. Fahr. That is about the limit cast-iron recuperators will stand for any time. Cast-iron recuperators are out of the question if efficient air preheating is considered at 2,000 deg. Fahr. furnace temperature and above. Some fifty years ago, cast-iron recuperators have been used very extensively in some metallurgical furnaces, and especially for preheating air on a large scale, at iron blast furnaces. They have all disappeared as unpractical and have been replaced by reversible regenerative heat exchange systems.

Nichrome recuperator parts for the hottest zone have been considered by some prominent industrial gas engineers but it remains doubtful whether those expensive metals will be profitable as material for a recuperator. Using heat resisting alloys, the temperature of air preheat could be increased some hundred degrees over cast iron, and the limit would be given probably at 1,900 deg. Fahr. for recuperator walls and many hundred degrees lower, as temperature of preheated air.

Still higher preheat temperatures are possible in fire clay recuperators, which are used successfully in some cases. But the drawback is that after some usage the fire clay recuperators are liable to become leaky or are damaged by corrosive slagging action of dust or furnace products carried over into the recuperator.

The highest air preheat temperatures are realized in reversible checkerwork regenerators, which type is usd in the United States only in large open hearth steel making, glass melting and other furnaces.

Theory of Recuperation which Checks with Practice

There is an excellent theoretical work on the effect of regeneration and recuperation in furnaces written by Quenaux and Damour, and other longer most useful monographs on theory of furnaces. But unfortunately, most desirable practical technical data on furnaces are very scarce, due to considerable expense connected with furnace experiments of any size. Any abstract theory is only as much of practical value as it coincides with actual results, and helps to obtain better results.

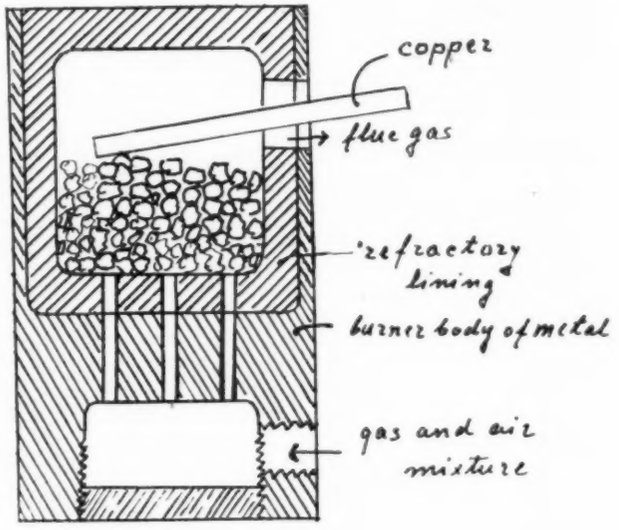
On the other hand, the value of individual practical observation is increased, if the scattered facts can be checked and covered by a generalizing working theory.

After analyzing the results of practical experiments with preheating, a rule was sought which would permit of generalizing them, and permit predicting the saving of fuel for a given furnace temperature, and temperature of preheat. Such a general rule could be expressed as follows: The fuel consumptions with and without preheated air for the same furnace are inversely proportional to the available heats of flame in both cases.

From this rule a second one can be derived: The percentage of fuel saved, due to preheating of air is proportional to the ratio of heat in hot air, and the available heat of fuel burned with hot air.

To check over this rule table 3 was computed, and the results of computation plotted in diagram (fig. 4). To show the method of computation, one example might suffice. Let the furnace temperature be 1,800 deg. Fahr. At this temperature, the available heat in gas burned with cold air is 307 B.t.u. per cubic foot of gas burned, according to table 3. If 407 cu. ft. of air necessary for combustion of one cubic foot of gas are preheated to 400 deg. Fahr. it contains 30 B.t.u. These thirty heat units brought back from the waste heat increase the available heat of gas to 307 plus 30 equals 337 B.t.u. per cubic foot of gas burned. Saving of gas equals $30/337 \times 100 = 8.9$ per cent. In the same way the percentage of saving has been figured for different degrees of air preheat and furnace temperatures of 1,400 deg. Fahr., 1,800, 2,200, 2,600 and 2,800 deg. Fahr.

To avoid any misunderstanding, it is emphasized



that the saving is not proportional to the increase of total heat of the flame, but much more, namely, to the increase in its available heat. It should be so, because what really heats the furnace is the available heat liberated by the temperature drop of the flame to the furnace temperature, while all the heat contained in the flame below the furnace temperature is useless or waste heat so far as the heating chamber or "the laboratory" of the furnace is concerned. That the preheating of air economizes more in fuel than the heat value brought in by preheated air has been proven, also in experimental tests carried out in cement burning kilns.

The preheating of air increases the flame temperature. Increased flame temperature betters the heat utilization or efficiency of the flame, and general fuel efficiency.

Let us compare a direct-fired and a preheated air furnace with furnace temperatures of 2,800 deg. Fahr. In the direct-fired furnace, the available heat of the flame is only 172 B.t.u. per cubic foot of gas burned (see table 3). Let the hot air have a temperature of 2,000 deg. Fahr. Then it brings into the laboratory extra 162 B.t.u. per cubic foot of gas which increased the available heat of flame to 172 plus 162 equals 334 B.t.u., or almost doubles the utilizable or available heat, consequently the gas saved due to preheat must decrease almost twice. It is plain that the decrease in gas consumption due to 162 B.t.u. in hot air, should be more than the increase in total heat of flame or more than 172/507 plus 162 equals 25 per cent.

The actual experimental savings due to preheat are shown on diagram (fig. 4) by round circles. They

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What Advertising Did for One Small Town Gasman

A Paper to Be Read at the Annual Convention of the A. G. A.

By CARL B. WYCKOFF
Manager, Emporia Gas Company, Emporia, Kansas

In starting this paper I feel about the same as I did when I had advised myself of the actual conditions that existed in Emporia at the time I took charge of that company a year and a half ago. The subject is a momentous one, and there are so many angles to it that one hardly knows where to start, especially with a paper. In my actual experience it was different, as there was only one thing to do, and that was to jump right into the middle of it and to work my way out in all directions.

I feel that it would be well for you to have a general idea of conditions in my city when I started. This will emphasize the possible results to be obtained from proper advertising and publicity. Briefly, our condition was this: Our annual sales averaged 25,000,000 ft.; leakage, 15 per cent. The company had never in its history paid a cent of dividends. We were four years behind in our bond interest, and were giving the poorest service I ever saw. During the peak loads at meal times the gas pressure was not over one-half inch and a great many consumers could not even light their their stoves. The town had had natural gas, with its equivalent cheap rates, up until eight years previous and as a result the plant and general conditions were nearly hopeless. We were in debt on current accounts more than our average billing for two months. Our creditors were threatening suit and the bondholders were insisting upon closing up the business. The banks had shut down tight on our credit and the consumers were very antagonistic. Otherwise everything was all right.

Here's an open-and-shut, honest-to-goodness statement of facts that should make every gasman in the United States proud to be associated with an industry that can boast of such men as Mr. Wyckoff. He's what might be termed a "humdinger."—Editor.

Speaking in parenthesis, I will say at this point that it had always been my plan that when I had received sufficient experience in all of the other phases of the gas business, I would like to take up the managerial end. I had always figured that it would be my desire to get hold of a property that was in as run down a condition as possible, as I would then have an opportunity to attain the maximum results from my previous experience and study. I found all such hopes fully satisfied in Emporia and there was nothing lacking in this line.

When I took charge we were losing quite a large amount of money on operating expenses alone. In addition to this, as I said before, we had not paid a cent of bond interest for years. There had never been any fixed or reserve charges set up. Such a thing as earning depreciation was considered an impossibility. On top of this, within thirty days, our contracts for coal and oil expired and we had to go into the open market, which meant a doubling of these costs and a consequent increase in our deficit.

I believe that you are now in a position to appreciate what confronted me when I began the work of computing a new and proper rate for Emporia. I also presume that you can realize how I felt when I arrived at the conclusion that it would be absolutely necessary to have a 90 per cent increase to properly handle the situation. A few months earlier our company had put in an increase of 25 cents per thousand and the people were up in arms. They had also installed a readiness-to-serve charge of 25 cents and this had aroused the wrath of the people. Our franchise called for a maximum rate of $2 and the law stated that it was necessary to go before the people in a general election before we could exceed our franchise rates. The very best rate that I could figure was a maximum rate of $2.50 with an additional readiness-to-serve charge of $1 to all and a minimum bill of $2.

A Problem Presents Itself

Now when I had arrived at the above, the next question was: How was I going to do it? There was only one answer and that was to sell the idea to the people and make them see it as I did. This was unquestionably a problem. I had never written an advertisement in my life. I had no one to do the work for me and could not have paid for the service had it been procurable. So it was up to me. Then and there I planned my publicity policy. Under existing conditions, it was necessary for me to plan to meet any emergency that might arise, even to the closing down of the plant.

Being a stranger in town I, of course, had no idea as to "who was who," or as to the best way of approaching the various people with whom I had to deal. It was easy to see that the only system to fol-

low was the old one of all cards on the table face up, and to call a spade a spade. I assured myself that what I had decided as right, was right. Then I went ahead on a stand-pat platform not to vary one iota from my original plans, which were to give Emporia first-class service and a first-class gas company—one that would be a credit to the town in addition to being a financial success and a going concern. I would either do these things, I said to myself, or I would junk the plant and end the agony.

To do this, I decided that it would be impossible to convert the whole town at one time. I therefore felt that it would be better to proceed quietly and to sell myself to the "powers that might be" at first, and then take on the others as I got around to them. The coal situation at this time was at its worst, but it happened to be quite a fortunate thing for me. I had to take up my troubles along this line with the president of our chamber of commerce, who was the most powerful business man in the town, and I was also brought into contact with the editor of the leading paper in the city. As luck would have it, he is a national figure politically and an exceptionally fair-minded and broad-gauged man. These coal troubles lasted over a period of six weeks and at the end of this time, due to sincere efforts, I had sold these two parties and now had three people, including myself, at work on the solution of the gas company's problems.

In the meantime, I had materially improved the service. It is true that it was done to some extent in a very crude way, but the end was accomplished nevertheless. The distribution system was waterlogged and the task of locating and repairing these troubles was too great to wait upon. I therefore resorted to the old stunt of weighting down the holder. I piled tons and tons of bricks on the top of it and forced the gas out during the peak loads, throttling it down the best that I could during the minimum. My resources only permitted me to put two men at work locating distribution troubles, but by tackling them properly and systematically we were able to make very good progress. All this took money and more money than we had, but by the proper application of publicity and advertising we were able to get a little credit, although we were going deeper into the red all the time.

With improved service, I created the confidence of the people to some extent. Of course, I had the proposition to overcome that my predecessors had also promised wonders but had failed to accomplish them. That is the thing that was thrown up to me at first. With improved service this disposition to distrust began to disappear and people were inclined to think that there was a better day ahead. When I had accomplished this much I started a systematic advertising campaign. The point in mind in this initial work was to acquaint the people with the fact that the war had hit the gas companies in common with all other business and that their town was not the only one that had to have increased gas rates. I made it a rule to publish three small items every other day in the local papers regarding the gas situation. I did not care for this to appear as a campaign just yet and therefore let every other day go by without anything pertaining to our business. In two of these items, for instance, I would announce where some city had been granted a rate increase; but I would never state the percentage of increase or the amount of the new rate unless, as rarely happened, it exceeded the one I had in mind. The other item was a very short, concise one telling of some company, like Galena, Ill., which had actually junked its plant. I carefully went over all the available trade journals and clipped out and classified all the articles that might be of possible assistance to me. In this way, I was prepared to meet any possible emergency that might arise.

I carried on this line of advertising for some time until the public was thoroughly awakened to the situation. Nothing was said about a new rate here in Emporia. The people eventually began to come to me and ask how much we were going to increase the gas rates. This question became a persistent one. When things had reached this point, however, I decided that it was time to start some real work, so I prepared a speech and arranged to be asked to appear before the board of directors of the chamber of commerce. I told them the actual conditions as they existed in our company, explaining every detail of the situation confronting their gas company as well as all other gas companies. I did not state the amount of the new rate required. I explicitly explained that I did not request that they pass any resolutions in my favor or take any action whatever as a body. I told them that all I wanted was their moral support and that I came before them because they were the representative business men of the city who should be advised of actual conditions that confronted a very important factor of their city. I made it plain that I was there to explain and answer anything that they might wish to ask.

Patience Brings a Reward

The discussion that followed was a most interesting one and proved very valuable to all. Of course, right here is where I secured my reward for having proceeded slowly with the matter and having convinced a few very prominent men beforehand. These men asked questions that brought out answers which helped greatly. This board of directors only consisted of ten men and when the meeting closed they were all absolutely sold. This gave me about a dozen substantial men in my favor. I then proceeded to speak before every organized body in the town before which I could gain an audience. I always arranged it so as to be invited to speak. I made as many as three speeches a day. I always had converts in the audiences that were ready to ask proper questions at proper times and help keep the rest of them in the center of the boat. I had copies of my speech made and gave them out, stating that I was making no statements that I could not prove or any promises that I would not fulfill. There was no publicity given these meetings, as I preferred to continue my plan of not trying to handle the public as a whole in one bunch, but rather to take them a few at a time. This worked out fine.

The next move was to have members of these various boards of directors and the city commissioners meet with me at a luncheon. I then went all over the matter again for the benefit of the commissioners. There was not a man in this crowd that was not sold; and you can readily appreciate that with this support I had no trouble in convincing the city commissioners that the increase was necessary. I felt that they

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Why Should Gas Companies Sell Their Tar to Distillers

An Answer to a Question That Has Long Been Asked

By R. P. PERRY, New York

The title is a direct and leading question, addressed in good faith by the technical section of the American Gas Association to the largest tar distillers in the United States. It deserves and will receive a direct reply. In making this reply, I am speaking only for the company I represent. I believe, however, if the same question were addressed to other large tar distillers in this country, it would develop substantially the same line of reasoning as it proceeds from the technical and economic experience of the industry for the last twenty-five years. During that period we have seen normal and abnormal conditions, both of peace and war.

My general reply to the question is that by and large the gas companies (and also the by-product coke companies) have in the past and will in the future receive the best return for their tar by selling it to large well organized and well equipped tar distillers instead of working it up themselves. The facts are divided into two more or less distinct but closely interrelated classes, technical and economic. After one or two general observations, I will take up the facts in the order indicated but the interlocking is so close that I will be frequently passing from one division to the other and at times taking up both together.

Turning back to my assertion, please note carefully the words "by and large." I will readily admit the possibility of exceptional cases where a gas company here or a coke oven company there may for a year or two, or perhaps in still more isolated cases, for a series of years, get a higher return for their tar by working it up and disposing of the products themselves, but I believe you will see that in the nature of things these successes can only be the exceptions and not the rule. In other words, the exceptional cases can succeed because they can hang on to the coat tails, so to speak, of the rest of the industry and enjoy the benefits without cost to themselves of what the industry has developed at great expense and over a quarter century of time. The reasons will appear as the article progresses.

What is this "tar" which we are talking about? The dictionary gives a generic definition as a brownish black more or less viscid liquid produced as a by-product in the manufacture of gas or coke. But what is it commercially? It is the name applied broadly to raw material as different in quality as the proverbial chalk and cheese. It is material fully as variable in quality as the widely differing petroleum oils from light Pennsylvania to heavy Mexican but, unlike petroleum oil, the value of a particular tar, even at any one period of time, is not secured by distilling it by itself. The best values in a well-rounded tar refining business follow from the blending of at least two or more tars of quite widely varying characteristics which do not come from the same gas works or coke oven plant. This is another important assertion which should be examined in detail.

There are three main classes or groups of tars in the United States—Coke oven tar, gas works coal tar and water gas tar. Each of these groups has many varieties, so that while a given tar belongs in general in one group it may nevertheless in certain characteristics belong in another group entirely and require individual treatment. I am not going to weary you with tables showing the tests of different tars, as such information is available in numerous articles and books, but I do wish to point out briefly the characteristics usually and at present most important to the tar distillers and the variations common in our experience.

Characteristics	Variations
Water—Not only of no value but an expensive nuisance to remove.	Generally from less than 1 per cent up to 8 or 10 per cent and sometimes over 40 per cent.
Free Carbon—Portion insoluble in benzol—not only of importance as regards the tar itself but as largely determining and limiting the use of the pitch product which forms 50 to to 75 per cent of the tar.	From less than 1 per cent to over 85 per cent (based on the dry tar).
Viscosity—In general indicating fluidity—of decisive importance for many uses, such as Tarvia for roads, saturating tars, paints, etc.	From one and a third to twenty times as viscous as water at a given temperature.
Yield of Oil Distillate to Roofing Pitch — The quantity as well as the quality of this oil has a great deal to do with the tar value if and when roofing pitch is to be made.	From 16 per cent to 31 per cent.
Yield of Oil Distillate to Very Hard Pitch—The quantity as well as the quality of this oil similarly determines very largely the tar value when (as is often the case) the normal pitch outlets are oversupplied and oils become the main product of tar distillation with hard pitch as a by-product.	From 35 per cent to 55 per cent.

Pitch Yield and Quality— These depend on the free carbon and other characteristics of the tar. The quantity generally amounts to from 50 to 75 per cent of the dry tar.

Some of you will be surprised that in this list I have said nothing so far about special chemical constituents, such as naphthalene, anthracene, tar acids, etc., and you are wondering whether I have not forgotten the great coal-tar chemical industry which we are trying to build up in this country to replace supplies from Germany and other foreign sources. I have not forgotten it in the least and the development of this industry is of national importance, but as a rule (there was a temporary exception during the war) these chemical constituents play only a relatively small part in determining the value of a gallon of tar. The reason is that at any given time the total amount of these chemical products recovered from any particular tar represents usually less than 10 per cent of the particular tar and generally less than 2 per cent of the total tar worked by our company. The largest single item—naphthalene—as recovered in practice represents generally less than 4 per cent of any individual tar. While all these refined chemical products are important and do play a part in determining the tar values, nevertheless their part is less in comparison than the part which tar itself plays in determining the values obtained from coal in gas or coke operation. Like tar, they play the minor role of by-products. When the quality of tar is very poor, we have often tried to get the gas works manager to change his operation a little so as to improve the tar, but to the best of my recollection we have yet to get any answer other than that tar is a by-product and must come as the gas operation makes it.

You will also note that I say nothing whatever about the benzol and toluol content of the tar. In most tars these constituents are so negligible and they are obtainable so much easier and cheaper by washing the gas that we have not for years recovered benzol and toluol from tar oils except during the war and in a few special cases where the recovery is incidental to other products. The main values must come from the 90 to 95 per cent balance of the tar. The chemical products will, however, be discussed further a little later on.

The water content of tar, frequently running up to 6 or 8 per cent and sometimes to over 40 per cent, is more of a factor than most gas companies appear willing to recognize. In the case of many tars the last few per cent and sometimes more can only be removed commercially by a distilling process. In this connection it is well to remember that on account of its high specific and latent heat of vaporization it requires about five times as many B.t.u. to vaporize a unit of water compared to a unit of tar oil. From the tar distiller's point of view, it is not only the fuel that is wasted but also the extra and special apparatus he is required to install to dehydrate the tar and the separate and extra storage required which go to make up a part of the extra cost of working a wet tar. This extra cost sooner or later comes out of the gas company in the price they receive for their tar. One of the largest gas companies in the country has recently been complaining to us of the low price they receive for their tar, while at the same time they have been delivering, not as the exception but as the rule for over a year, tar containing from 8 to 25 per cent of water, which costs more than a cent per gallon of tar to remove when all factors are taken into account.

Turning, however, to the proper constituents of tar (which water is not) we find that most coke oven tars are moderate in free carbon (generally from 5 to 10 per cent) but extremely variable in viscosity (from 1½ to 10 times water) and extremely variable in oil distillate (from 18 to 31 per cent for roofing pitch and from 38 to 55 per cent for very hard pitch). The gas works coal tars vary greatly, depending upon the type of retorts, whether horizontal or vertical, as well as other factors, such as the temperature of carbonization and the size of the charge of coal in the retort. Vertical retort tars are low in free carbon (generally 2 to 4 per cent), low in viscosity and high in oil yield. Horizontal retort tars on the other hand are high in free carbon (generally 15 to 25 per cent), high in viscosity and low in oil yield. Water gas tars are very low in free carbon (generally about 1 per cent), high in yields of oil of an entirely different character and usually lower value than coal tar oils. The water gas tars are usually low in viscosity, although recently some of them have become so high in viscosity as to be almost useless to us for the purposes for which they were bought.

The pitches vary substantially in quality with the free carbon content of the tar from those made from very low carbon tars, such as vertical retort coal tar and water gas tar, which are very brittle and easily affected by temperature changes, through coke oven tar pitches which are somewhat less brittle, to the other extreme of pitches made from very high carbon tars, such as many of the horizontal retort coal tars. These latter pitches lack life and ductility and are very difficult to melt and in fact some of them are so "dead" as to be of no value for most of the known uses of pitches.

The business in tar products had not developed to its present volume and position of importance because of a natural popular demand for these products. With the exception of creosote oil for timber treatment, every coal tar product in this country has been marketed in a large way only as the result of a long up-hill campaign for years, with the expenditure of millions of dollars for advertising and development work. Instead of the public crying for tar products, we have had to educate them through engineers, architects and chemists to see that by proper combination of various tars and proper refining methods we can produce standardized commodities which will give high satisfaction over a long period of years.

Some of you gasmen can go back to the old days when tar was a nuisance which must be dumped into the river or ocean to get rid of it. The early tar distillers who made pitch for roofing purposes had to compete from the very beginning against strong and cleverly handled promotion on the part of the asphalt companies, who spread far and wide a glamor around the word "asphalt." One of the most important reasons why the early tar distillers nearly failed in their effort to market their products was the fact that these distillers, operating as local units, had not developed laboratories and testing methods and blindly thought, as some gas engineers do to-day, that tar was tar.

To be more specific, let me take the case of coal tar pitch for so-called gravel or slag roofs on substan-

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As the Journal Views It

Our Western Office

The AMERICAN GAS JOURNAL, in its efforts to increase the value of its service to the gas industry, has established an office in Chicago, with Roy W. Brown as manager. In taking this step the JOURNAL was animated by a desire to render as efficient service as possible both to its readers and to the advertising profession. The establishment of this office comes as a result of a demand for a headquarters in the Middle West, where the gasman will find the same welcome as he has been accustomed to get when he visits New York City.

Mr. Brown, who joins the staff of the AMERICAN GAS JOURNAL, needs no introduction to the members of the gas industry, as he has been an important factor for the past six years and has made a wide circle of friends, who will welcome the announcement that he has joined forces with the AMERICAN GAS JOURNAL.

The AMERICAN GAS JOURNAL invites all gasmen who may visit Chicago to make their headquarters at this Western office, which is centrally located in the Peoples' Gas Building, and assures them of a warm welcome.

Preheated Gas-Fired Furnace

A great deal of the space of this issue of the AMERICAN GAS JOURNAL is devoted to the report of an investigation that was conducted by O. Lellep in connection with preheated gas-fired furnaces. This investigation, we are told, covered many months and involved the expenditure of considerable amounts of money, but we are sure that our readers will agree with us in the statement that the results warranted the expenditure. Gasmen will find answered in this article questions that have been constantly arising during the

past year. Here, however, is an authorit tive statement that will solve most of the problems that have been presented and will act as a guide for those who are interested in this really important subject.

A large amount of gas literature follows along certain given lines and, while it expresses a constructive thought, is apt o stick too close to axioms to render a really great service. This article, however, which is published as the leading one of the week, sheds new light on the subject and has been so carefully prepared that there can be no doubt of its value.

In discussing this advance the AMERICAN GAS JOURNAL also desires to announce that it has arranged with the leading men of the gas industry for articles that will be published during the course of the year. At the present time there are being prepared articles that will surely show the way to the solution of many vexing problems and will act as a guide for the operation of many plants.

We advise a close perusal of the columns of the JOURNAL.

Is There a Drive on to Decrease Rates?

Indications are, as this edition of the AMERICAN GAS JOURNAL goes to press, that there is getting under way a movement to force the decrease of gas rates. This is particularly true of certain States in the East, and as an example New York State may be mentioned. Just why this is the time that a drive should be made on gas companies, in particular, it is hard to understand, unless there is attached a political significance that would hold up the gas industry as a sacrifice to make a holiday for the politicians.

In New York State the Public Service Commission has stated that it will begin an investigation of the rates charged by companies in the metropolitan district, with a view to forcing a reduction at once. Perhaps the approach of Election Day has something to do with it; perhaps it hasn't. But at any rate, a disinterested bystander will be given cause to wonder.

There have been no developments in the gas field during the past several months that would warrant a drive at the present time in forcing a reduction in rates.

Costs have not droppe dabnormally so that utilities generally are in a position where there is a surplus of money being taken in and paid out in large dividends to the security holders. On the contrary, an investigation would show that any sums that are being derived from the sale of gas are being put back in the plants of the different companies so that they may be more efficient. If it becomes necessary to once again stop the construction programs of gas companies, then truly this industry will be in a condition that even the war period could not equal, and it will be the consumer who will be forced to stand the gaff while the politicians once again proclaim a victory for the "pepul."

We believe it is the duty of every gas company executive to at once bring before the community served by his company the condition as he sees it from a local standpoint. If this is done promptly there can be no doubt as to the outcome, but if there is any delay there is likely to be a serious outcome that will act as a setback that will be desperately hard to overcome.

It is true that there have been decreases in certain of the materials that are used in manufacturing. They were bound to come, for even with an increased rate it was impossible for the gas companies to pay the prices asked and continue in business. Such decreases as there have been have only served to help out in relieving a situation that was so threatening that even the politicians had backed down from their original stands and were willing to concede some of the rights that belong to us.

It is to be hoped that gas company men will not lack the courage to go before their people with the truth of the present situation. That is going to be the only way that the problem can be solved, but action is necessary right now.

What Advertising Did for One Small Town Gasman

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would naturally be governed to some extent by public opinion and my idea was to prepare this opinion for them. After all, they have their bread and butter to make the same as you and I.

It was at thi smeeting that I first announced the exact amount of the increase. I arranged to have this meeting take place the day before the regular meeting of the city commissioners and at their meeting I had my lawyer hand them a copy of the new rates. My story was already set up at the newspaper office announcing the new rates and giving the facts in brief and as I thought best. I ordered this printed and sent out the notices to the consumers which thoroughly explained the case to them.

Instead of calling the extra dollar a readiness-to serve charge I added it on to the first 100 ft. and used the Thwing system of hundreds. There had been so much agitation over the previous readiness-to-serve charge of 25 cents that I knew they would be antagonistic to it. I thought I could get it in this way and I was right, for the question most often asked me was: "What about that quarter readiness-to-serve holdup?" To this I answered that there would be no readiness-to-serve in the future and that there were no additional charges beyond $1.25 for the first 100 ft. and 25 cents for each additional hundred feet. Everyone seemed greatly pleased that this 25 cents had been eliminated.

New Rates Effective

The new rates became effective on the fifteenth of October, 1920. It was very unfortunate that it had to occur at this time of the year, as this town is composed of retired farmers and we have no industries

at all. The majority of the people here prefer a coal range when they can stand it; and an oil stove is a treasure to them. The result of the new prices was that we lost business and consumers at a demoralizing rate. Conditions were fast becoming critical and I decided that I would have to carry out some line of publicity that would assist the case. I thought that a set of heart-to-heart talks would do the work and I started by "Chats with the Gasman." These talks were for a twofold purpose: To stop the loss of consumers and to prepare those who stayed by us for their first gas bill. In these "chats" I tried to condense what I had to say into as few words as possible. People will read a third of a column but they will not read a longer one. I attached a good deal of importance to the title and thought quite a while before deciding upon it.

The main idea of the "chats" was to convince the people that it really costs money to make gas, the same as it costs money to manufacture anything else, that gas has a real and actual value; that it costs money to make good gas and to give good gas service; what gas service means; and that a large proportion of their expenses of to-day were for the luxuries of yesterday. The point was also emphasized that the money spent for gas service brought consumers far better returns than any other money that they spent. I made these "chats" educational also, trying to cover the ordinary differences and misunderstandings that exist between the company and the consumer. I secured a preferred location in the newspapers and had them appear every day in exactly the same place in the paper. This location immediately followed the society column, for it is the women to whom you must advertise the gas business.

This line of publicity proved most successful, and there was not one single case of any opposition to it. Of course, I had plenty of individual complaints, but there was no concerted action taken. We continued to lose business but the usual remark from consumers was that they could not afford to use gas at the new rates. They felt that we were justified in asking them and had to have them, but they also felt that they could not afford them. The "chat" ads not only assisted in bringing about a satisfactory understanding, but they developed a friendly, personal feeling towards me by the community. Also I will state that the people of Emporia, as a whole, have a very clear understanding of the perplexities of the gas business—far more so, I will venture to say, than any other community.

Along with the "chats" I carried an interesting line of advertisements in my display space. I make it a rule never to let an advertisement stay in more than three days and seldom more than two. Advertisements that stay in longer cease to be of interest and the public does not pay any attention to them. On two days my ads apply to coke, two days to gas appliances and the remaining two I insert some snappy little original piece of poetry. I try to make all of my advertising a little different from the regular run of stereotyped matter. I find that all of my copy is read, for the people get the habit and feel that if they do not read it all they are apt to miss something. I get a good deal of good-natured kidding sometimes, but that is a very good sign that my matter is read. It is surprising the amount of good-will and good personal relationship a line of such ads will get.

Condition of To-day

I told you at the start the conditions that I found our company in, and I will now give you an idea of conditions as they exist to-day. We are making a good return upon our investment and are setting aside ample funds for depreciation and other reserve charges. We are giving good service; are improving our property and are paying two months' bond interest each month. We are selling more gas at the new rates than we sold at the old ones.

Conditions have materially improved with us. We have made two voluntary rate reductions at the time this paper is being written and there is no question but what the third will have been made by the time it is read.

As I have stated before, the subject of advertising and publicity in a small town is a hard one to write about. You are so situated that you come in personal contact with everyone. You are frequently the best-known man in town and the result is that you must live advertising every minute of your life. You fairly breathe it. Every movement and act is an advertisement either for the better or the worse of your company. The matter of psychology must be given the deepest consideration. You yourself must be absolutely sold on what you have in mind, and you must never, under any circumstances, try to put anything over on any one. Shout your promises from the hilltops but make no assertions that you cannot prove and no promises that you do not intend to live up to. Instill the public's confidence in you and you can have your own way. But if you betray their confidence, then your troubles will begin. Meet people personally. They think they are entitled to a personal interview and you must give it to them. That is the small town way; and when you are in a nine o'clock town there is only one thing to do, and that is to set your watch back a couple of hours and gauge yourself accordingly.

Carry yourself in a manner that will command the respect of the majority of the people with whom you have to deal. Then when an emergency arises you will find that you have their sympathy and that they will help you. Talk your problems over with them but do not bore them. Tell them the truth and you will never get caught in a lie. It is easy to tell the truth but it takes an artist to live a lie and get away with it. Do not buttonhole people, but never lose an opportunity to preach the good word. Radiate an atmosphere of sincerity and competence but never get chesty. It is very hard for small town folks to feel that their company is properly managed and that the high rates are necessary when the manager is a booze fighter, a sport or is never attending to his business. You must take an interest in community affairs for that is the best kind of advertising. You must be honest; run your business efficiently; make a good profit, but no more.

Advertising in a small town is about 10 per cent advertising and the balance pure missionary work, especially during these trying times. It is much more so when one is located in a community which has had natural gas and in a State where there are only six artificial gas plants. When the average bill is $6 for cooking it is unquestionably true that the consumer gets more actual value for this money than any other $6 that he spends. But it takes time and hard work to convince him of it, if he has been used to getting

all the gas he wanted for a dollar and a quarter; and much more time and effort if he is the type of man that has not been educated to the conveniences of life.

A Definite Line of Procedure

The most important thing to consider first in any advertising or publicity campaign is to have some definite line of procedure. Having done this, you must then decide just what type of people you are going to endeavor to reach and be governed accordingly. All people are not the same; and you must study the different types and approach them in the proper way. If they are blind in one eye, you should approach them from the other side and they will not be so apt to kick over the traces.

I fully appreciate the true art of advertising and do not propose to say anything to discount it, but for the benefit of the doubtful and hesitating ones, I will say that it is simple to-day. Read your technical journals. They furnish you a great deal of material I secure a world of assistance from them. The American Gas Association furnishes you ten times as much material as you will need. Their advertising service furnishes you each month, for a nominal charge, a display ad that is excellent. The association is at your service at all times simply for the asking. If you are still short on material you can subscribe for the Emporia *Gazette*. You will find three advertisements each week and they will be all "just a little different." Use catch phrases under the company name in your display advertising. Here are a few examples: "Don't cook the cook," "Why cook the cook," "Emancipate the cook," "Lift Emporia out of the soot," and many others. They are easily written and are quite a help.

It is a hard subject to write about. I have talked about the conditions in my city, for we have unquestionably met with all the success that one could hope for; and I am glad to say that a frank and open policy of publicity and advertising has done it It naturally occurred to me that what helped our company also would help others.

Experimental Comparison of a Preheated Air Furnace with a Direct-Fired Furnace

(*Continued from page 252.*)

coincide practically with theoretical curves. Consequently, the curves are valid for practical purposes, at least in the temperature region of the experiments made.

The effect of preheated air on fuel saving is more pronounced for producer gas than for city gas, as the percentage of available heat in producer gas is lower than in city gas for the same temperature.

The Efficiency of the Experimental Recuperator

If the efficiency of recuperator is defined as heat in waste gases or heat transmitted to air, this efficiency is very low for this type and size of furnace varying from 17 to 27 per cent, depending from temperature.

For large and high temperature open hearth steel making furnaces, Professor J. W. Richards figures the efficiency of regenerators up to 80 per cent. These efficiencies are possible in furnaces using one hundred times and more gas than the experimental furnace, which corresponds more to actual size of city gas heated furnaces.

Some Practical Examples

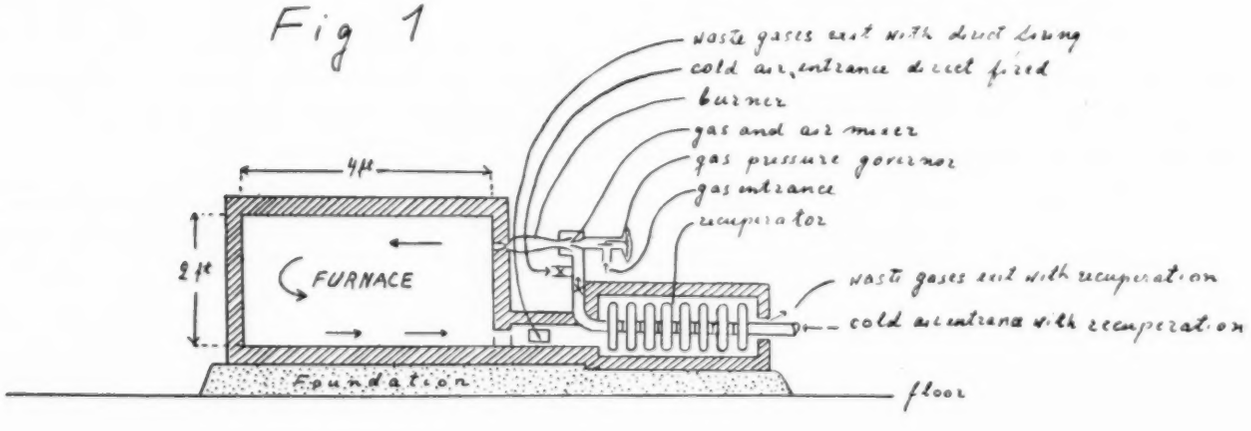
A small tool hardening furnace with a hearth ten by sixteen inches, for 1,450 deg. Fahr.

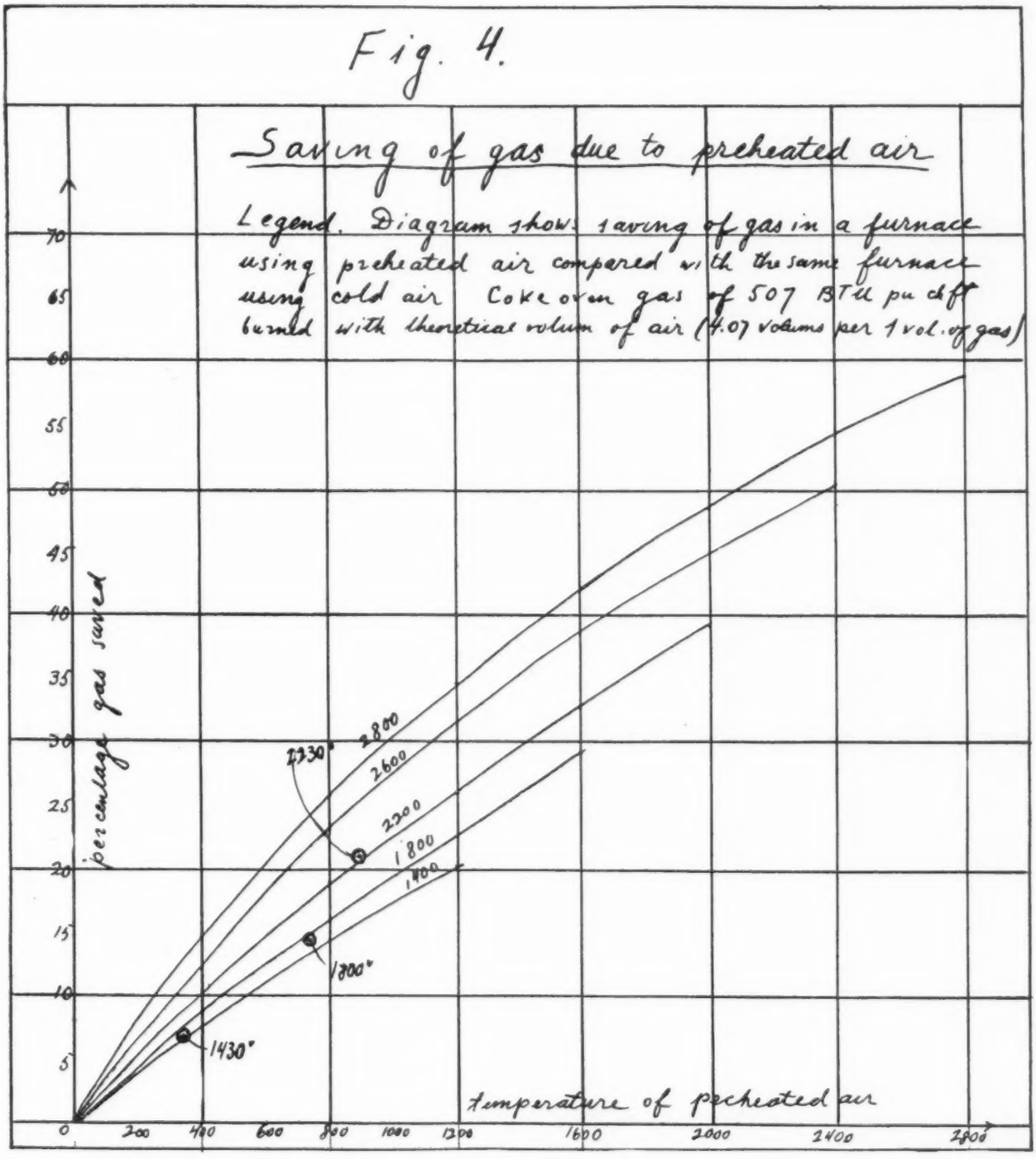
Average gas consumption per hour 100 cu. ft, working 1,000 hrs. per year. Yearly gas consumption 100,000 cu. ft., costing $100.

As the furnace door cannot be closed all the time, the probable air preheat temperature in this small furnace will be, say 250 deg. Fahr., corresponding to a gas saving of 4½ per cent, or for $4.50 per year. This saving does not pay for the initial cost, upkeep, and renewal of recuperator.

2. An enameling oven with inside dimensions of the muffle, three and a half feet wide, eight and a half feet long and three and a half feet high is used in the daytime and kept hot during the night. Gas consumption per twenty-four hours is 8,000 cu. ft. The average temperature around the muffle 1,500 deg. Fahr. Yearly gas bill $2,400. Due to untightness of the muffle and furnace walls, periodical openings of the door and heat losses in pipng, the probable average air preheat temperature is 350 deg. Fahr., cor-

Fig 1





responding to a gas saving of 6½ per cent or 2,400 × 0.065 = $156.

This recuperator will pay for itself provided its yearly upkeep and depreciation is below 156 dollars. Data available to the writer from practical installations are divided as to the merits of recuperation in this case.

3. A 200-lb crucible brass-melting furnace has a furnace temperature of 2,200 deg. Fahr., a yearly gas bill of $400, and temperature of preheated air 700 deg. Fahr.

Diagram (fig. 4) gives a gas saving of 16½ per cent or $66 per year, from which sum the upkeep and depreciation of the recuperator have to be deducted. With so small a margin of probable saving the adoption of recuperative furnace remains a matter of personal preference of the buyer.

4. Forge furnaces have to work with the working door or slot open so that only a small part of waste heat is returned to the furnace by preheated air, the temperature of which remains generally below 300 deg. Fahr., although the furnace temperature is 2,200

deg. Fahr. This low preheating temperature causes so small a saving in fuel cost, that hardly any recuperator is justified.

5. Small glass melting or porcelain burning furnaces with working temperature of 2,600 deg. Fahr. are in exceptional cases using city gas. The available heat in directly burned city gas at these extreme temperatures, is so small that any additional heat carried in by preheated air has big influence on gas saving.

A cast-iron preheater could give maximum air preheating temperature of 1,000 deg. Fahr. with a saving of 27 per cent. If the furnaces are sufficiently large a checkerwork regenerator air preheating system could be used, with air preheat temperature, and a saving in fuel about two times higher than in recuperator furnace. Provided, the air preheater is not deteriorated by slogging action of alkaline gases or corrosive dust, a regenerative system of air preheating can be recommended.

6. A large continuous tool steel hardening furnace, for 1,450 deg. Fahr. with a hearth two feet wide, by twelve feet long, consuming an average of 600 cu. ft. of gas per hour, and working 3,000 hrs. per year. The hot waste gases can be utilized in the easiest way for preheating the cold articles, to be pushed into the furnace, which arrangement is simpler and more efficient for heat saving than a recuperator.

7. Some well-known gas furnace firm in Europe advertised in a special booklet preheated air heat treatment furnaces giving "unprecedented" gas economies. An up-to-date furnace concern in this country can surpass the given figures by far, simply using well-insulated walls and efficient burner equipment without any preheated air.

Holding Consumptions in Cubic Feet Per Hour

Furnace temperature, degrees Fahrenheit	1,470	1,832	2,190	2,370
European firm—preheated air regenerative furnace	200	300	470	600
American firm—cold air automatically proportioned	132	222	300	540

These figures are not intended to show that an air

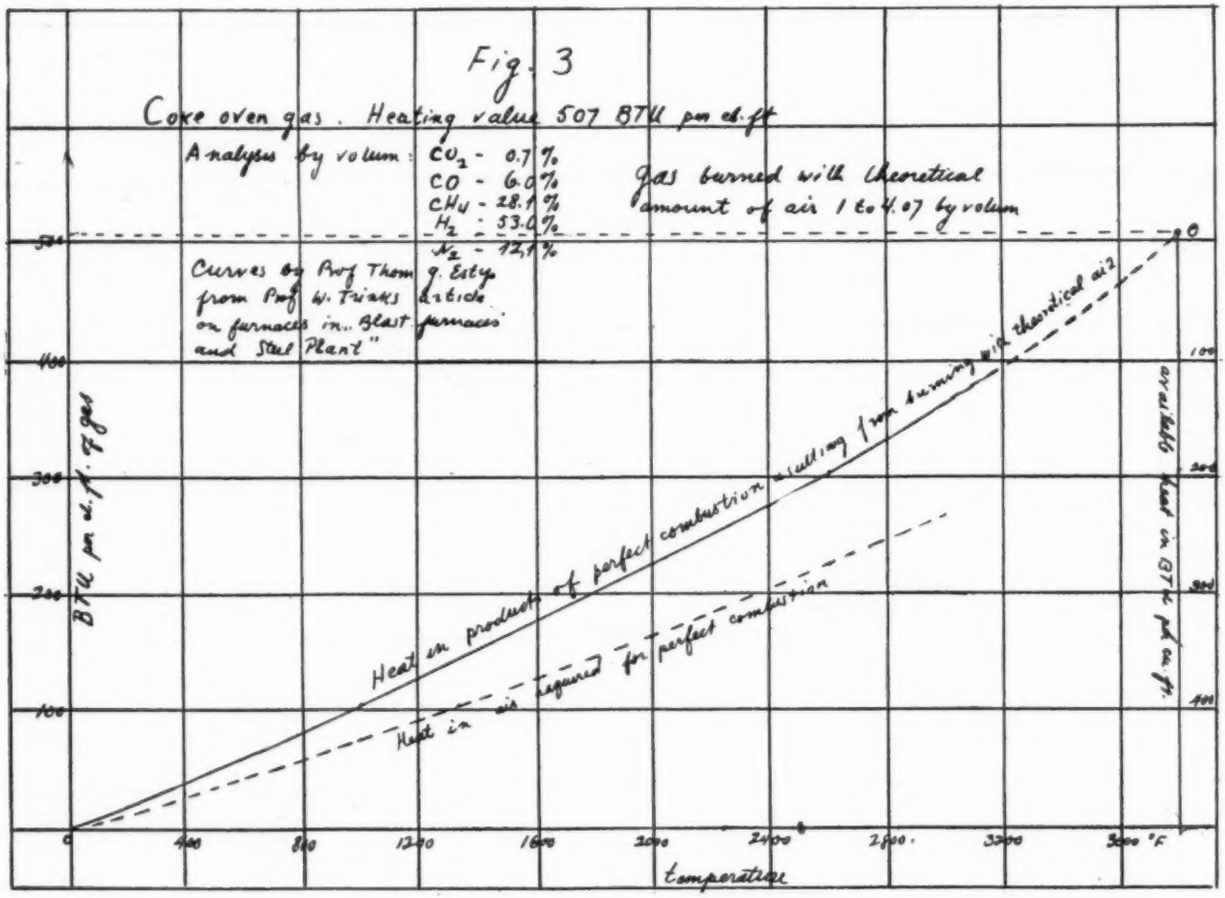


Fig. 3
Coke oven gas. Heating value 507 BTU per cu. ft.
Analysis by volum: CO_2 - 0.7 %
CO - 6.0 %
CH_4 - 28.1 %
H_2 - 53.0 %
N_2 - 12.1 %
Gas burned with theoretical amount of air 1 to 4.07 by volum
Curves by Prof Thom. Estys from Prof W. Triaks article on furnaces in "Blast furnaces and Steel Plant"
BTU per cu. ft. gas
available heat in BTU per cu. ft.
Heat in products of perfect combustion resulting from burning with theoretical air
Heat in air required for perfect combustion
temperature
0
400
800
1200
1600
2000
2400
2800
3200
3600 °F

preheating system is not advisable in general. Doubtless from two similar furnaces with equally insulated walls, and equal conditions for heat generation, and heat utilization, the furnace with preheated air is more economical as shown on diagram (fig. 4).

Apparently the European manufacturer had neglected some important feature on his design, like proper insulation, adequate mixing of gas and air, etc. Therefore, it looks advisable before deciding to buy a recuperator furnace to inquire whether a modern direct-fired gas furnace will not give the same or better fuel economy. If so, the direct-fired furnace is preferable, due to its simplicity and cheapness.

Conclusions

The saving of fuel due to preheated air depends largely from two factors: from the working temperature of the furnace, and the temperature of preheat. The higher the furnace temperature, the more pronounced the gas saving effect of preheated air. Saving of fuel is almost proportional to the temperature of preheat.

2. It does not pay generally to use air preheating for city gas in furnaces operated below 1,800 deg. Fahr., particularly so in small furnaces, with average gas consumption below, say 500 cu. ft. per hour.

3. Air preheating is more justified for high temperature furnaces working near or above 2,000 deg. Fahr. provided the waste gases can be directed into the heat exchanging system, and the furnace is consuming over 500 cu. ft. per hour.

4. Cast-iron recuperators have a short life, if used above red heat, and therefore cannot be used efficiently at higher temperatures where the air preheating is most advantageous.

5. In a furnace with 2,600 deg. Fahr. a reversible regenerating checkerwork air preheater is liable to cause twice higher fuel saving, than a cast-iron recuperator, due to the limited air preheat temperature in the last type.

6. The claims raised in connection with air preheating are often misleading. Before introducing air preheating, which means complication of the equipment, and extra expense for upkeep, be sure that a modern up-to-date direct-fired furnace is less economical.

7. Surveying the field of possible application, it looks safe to say that in most cases the air preheating does not pay for industrial city gas furnaces, although there are some few attractive possibilities as exceptions to the general rule.

Why Should Gas Companies Sell Their Tar to Distillers

(*Continued from page* 256.)

tially flat surfaces. These roofs, as most of you know, are constructed by building up a number of layers of coal tar saturated felt, cemented together with coal tar pitch and having a surfacing coating of coal tar pitch, in which is embedded gravel or crushed slag as a wearing surface. In the early days these roofs sometimes failed and got in bad repute. Why? Often because the distillers thought tar was tar and that any tar would make satisfactory roofing pitch. So some of them made pitch out of high carbon gas works tar and although the pitch was tough in a way, it did not have enough cementing quality, nor did it have a long life. As a result, the plies of felt came apart and the gravel or slag came loose on the surface and washed away—blocking the gutters and down-spouts—and soon the roof leaked. In other cases the local tar distillers (corresponding to the local gas works) made pitch out of water gas tar and got a nice fluid pitch, which the roofers liked at first because it spread so easily and a ton went so far. But this very thinness was its undoing. Much of the pitch soaked into the felt, the plies came apart, the pitch on the surface seemed to dry up and disappear and the roof leaked. Gradually and practically only as the local tar distilling companies combined, compared notes, established testing methods and studied the problems, there developed the surprising fact that tar was not tar and that good roofing pitch could only be made in most cases by blending various tars. In one or two cases the gas companies, then in the distilling business, tried to get the same result by filtering the excess free carbon from their coal tar but they soon found the cost was prohibitive.

Even after the knowledge was developed of the differences between tars, the roofing pitch industry was still threatened by a corresponding lack of standardized methods of applying the roofing materials. There were in different parts of the country a considerable number of skilled roofers of the highest standing but their work was in competition with unskilled or "fly by night" roofers, who used the cheapest pitch available (generally water gas tar pitch) and took their chances of being out of the way by the time the roof leaked. The asphalt industry industriously spread around tales of such roofs which had failed. They presented laboratory tests to show that coal-tar pitch was more volatile and brittle than asphalt and fell into the error of assuming and asserting that these laboratory tests explained why a few coal-tar pitch and gravel roofs had failed. They disregarded, of course, the history of the large majority of cases where practical experience had shown that on substantially flat surfaces a properly constructed coal-tar pitch and felt roof gave by far the least cost per year of service.

The competition, however unfair, was nevertheless real, and our company took another most important step forward. It was not enough to make good pitch, we must educate the architects and the public to recognize and insist upon a reliable and standardized roof construction and so we developed Barrett Specification Roofing, with its twenty-year bonded guarantee, on which in advertising alone we have spent about $1,000,000. I say advisedly, if we or some other tar distillers operating on more than a local scale had not taken these steps, the gravel roofing industry would not exist appreciably to-day as relatively it does not exist in England or on the Continent. No individual gas company would have had the suitable variety of tars to make the mixtures which we found absolutely necessary if the product was to succeed and no individual gas company would have gone into the wide-spread study of the roofing industry or have been willing to spend the money we spent to educate the architects and owners to specify good materials, well put together, to make durable roofs. Our Barrett Specification business is now a large one but we are just beginning to get back a fair return for all of these years of work. We are getting some of the returns, of course, through other gravel roofing business because the Barrett Specification has set the standard. The less expensive roofs must measure up towards it even if they do not insure its high standard.

Gas companies and other public utilities are accustomed to lead the life (not by any means a bed of roses) of so-called natural monopolies. They take it as a matter of course nowadays. They know that with two or three gas companies in the same city there would be competition, which is said to be the life of trade but the death of profits. For years, until the war, this country was fed up politically to insist on free competition and let the devil take the hindmost, but it has been gradually dawning a little on the more enlightened people that the failure of the

hindmost is in the end a charge on society, which the consumer eventually pays for. It is now seen that there is "something," to say the least, in the merits of large companies when the public can exercise reasonable control over them.

It would be fine for the gas companies and ourselves if the consumers of tar products would only localize themselves to suit us, but they don't. There is far from a balanced condition. Nearly every large city and every large steel center (sometimes these two come together, as at Chicago) produces tar beyond its local consumption. Some large producing centers, such as Birmingham, Ala., have relatively no local consumption. What does this mean? It means either bringing together the tar at the points which as a matter of experience have proved the best distilling centers or shipping the surplus finished product from one territory to another, or to some extent both, and this would bring the different gas companies reaching after the same trade. You will no doubt wish to estimate what would be the probable net result from the business under such conditions.

What I have described in detail as to the technical development of gravel roofing and roofing pitch is also true of the use of tar for roads. Years ago tar was used in a small way for sidewalks and roads, but the results were so variable and unsatisfactory that it was abandoned. Sheet asphalt took its place for roads and cement or flagging for sidewalks. The trouble, of course, was partly unscientific application, but also largely the variable and unsatisfactory tar products following from trying to use any old tar which was locally cheapest.

Reference is sometimes made to the English experience where local gas companies in a great many cases do work up their own tar for roads and other uses, but conditions there are quite different. In the first place, in England it is recognized commercial practice for the various companies to act in combination with each other as to prices and sales in a way which the law does not permit here. The country is small, compact and on the whole densely populated. They do not have local supplies of asphalt to compete for roads and roofing as we do. Most important of all, remember they have in Wales and on the Continent a substantially local market for practically all of their excess tar in the form of briquette pitch, which we do not have in this country because of the still abundant and relatively cheap bituminous coal. "The burden of pitch" is one of the most serious problems of the tar industry in this country. We have developed some uses for hard pitch here which they do not have abroad but we greatly miss the briquette pitch outlet which they enjoy. At times we have been able to export some briquette pitch from Atlantic Coast points but after the freights and handling charges are deducted there is little left. In spite of spending large amounts of money in research and development work, the pitch uses, especially profitable uses, have not developed as rapidly as the increasing tar production, due to changing from beehive to by-product coke ovens. On more than one occasion we have had in stock pitch representing the product from more than 2,000,000 barrels of tar. The difference between English and American conditions as affecting the tar industry is as wide as the ocean between.

Let us now revert to the coal-tar chemical industry and see the technical and economic sides with relation to the question of who shall handle it—the individual producer or the large distiller.

Getting the coal tar chemical industry started in the United States in a large way was only made possible by the war. The Germans had too much headstart and when we or others developed individual products the Germans cut the price on these particular products to less than the cost of our raw materials and made it up on the price they charged for other products we were not yet producing. In some lines we had not only the German but also the English competition, with little or no tariff protection. I remember years ago, when the demand for tar acids was strong, we installed a plant at New York to extract the acids from the coal tar oils, but no sooner had we gotten started before the foreign price dropped to several cents under our cost and naturally we shut down the plant. It stayed shut down until the war shut off the foreign supply. Shutting off this foreign supply taught a great lesson to the consumers of coal tar chemicals in this country, who for years had refused to even consider the dangerous condition of having our dyestuffs and military high explosives made abroad or from foreign materials. Those who had opposed reasonable protection saw it would have been far better to pay a slightly higher price for a time instead of placing this business abroad and choking the industry here to death. Most of them are now willing to see a reasonable measure of protection for the coal tar chemical industry. I mention this subject merely in passing as one of monetary interest to the gas companies, whether you or we distill the tar.

The development of the coal tar chemical industry in this country has called for research work on a scale so large that no single gas company or group of gas companies were in position technically to undertake it. We have spent on research and development work during the last five years over $1,500,000. It is no great trick to be able to make naphthalene or to extract tar acids from tar oils, but to be successful the chemical industry cannot pick off one item at a time and bl itself. It requires a comprehensive and large-scale development and operation. Take anthracene, for example. It is not very hard technically to make crude anthracene but it is very hard to do it cheaply enough to compete with foreign anthracene and it is a great big job to develop a use for the other products recoverable at the same time with anthracene so as to get a reasonably low cost for each. Anthracene, by the way, is not present in water gas tar and the recoverable anthracene represents only about 0.3 per cent on the average coal tar. We have found in most cases it can only be recovered at a low cost when worked up with several other products and that means quite a large plant and a large and steady supply of tar to make it worth while. The result is we can only undertake it in plants combining the tar supplies from several producers. It would not pay any, except very large tar producers, to undertake such products, and again, if they were produced by a number of individual gas companies or groups of companies you would introduce the element of cost of selling and competition with each other, which would in my opinion more than offset the profits some of you think you lose by selling to the tar distiller.

This may all sound one-sided, with all the advantage lying with the private tar distiller. I am, how-

ever, a believer in the equilibrium theory of business and think it works in the tar business as in other cases. In the first place, there are several large tar distillers and there is a very real element of competition which raises the price of tar to a fair market value. When it goes too high, considering the market for finished products, we have to stop buying and let the other fellow take it and see if he can year after year make money out of it. The tar producer here gains the advantage of a stable market in that the price of tar is measured by the known conditions and possibilities of the market for finished product where the laws of supply and demand govern the situation. It is only the large organization with a diversified line that has facilities for acquiring this true measure. The producer of tar at all times enjoys a price based upon the keenest competition between the large distillers. The overproduction is taken care of and extreme peaks and hollows in the price line, that would be unavoidable in a purely local distribution, are unknown.

Perhaps it is well also for you to recall that large as is the production of gas works tar in this country, it only represents 30 per cent of the total and any comprehensive plan of tar disposal must take into account the larger by-product coke oven supplies, whose owners may not have the same point of view as some of the local gas companies.

This brings me to the next, to the last general point, and that is the variation in tar production, which I believe would be a serious handicap to any operation dependent on local supplies. The gas companies are naturally more stable in their operation than the coke ovens but gas fashions change and go from coal gas to water gas, to by-product coke oven gas, to vertical oven gas, and back again, bringing in their train changed and sometimes dismantled gas plants, as well as widely varying kinds of tars, as discussed above. As large tar distillers, we overcome this difficulty in most cases by strategically located distilling plants, drawing supplies from several producers. This means paying some freight but in the long run it has proved better than the experiment we have ourselves tried of plants individual to large single producers. I have in mind particularly one plant we built at a cost of several hundred thousand dollars, where the prospective tar production was over 500,000 bbl. of tar a year. The local conditions suddenly changed, the tar became so valuable for local fuel that it was worth more than for distilling purposes and our main distilling unit has never been operated. We have converted a part of the plant for use as a distributing station.

Gasoline Extraction from Natural Gas

In describing apparatus for the extraction of gasoline from natural gas, the Chicago Pneumatic Tool Company in its catalogue describes the compression method as follows:

"The compression system of extracting gasoline from natural gas is not a new discovery. However, it is only within the last few years that the demand has been such as to warrant any special effort along this line. It has now reached a point where it is not only profitable but is a necessity, as the supply from crude oil is no longer adequate for the demand, due to the rapid development and increased use of the gasoline engine.

"The first successful gasoline extraction plants were established about 1904. The equipment then was rather crude, consisting of ordinary gas pumps compressing to about 50 lb. pressure. The cooling of the compressed gas was effected by various methods, sometimes by allowing the gas to flow through coils of pipe buried in the earth, then again by these coils being placed in tanks of water. The condensate produced was allowed to drip into an open vessel and the losses resulting from evaporation were enormous.

"When this industry was found to be a commercial success many improvements were made in the methods employed, and especially in the design of the machinery used. It was soon discovered that a greater quantity of gasoline could be contained by compressing the gas to higher pressures. This necessitated a two-stage compressor, where pressures were increased to 400 lb. per square inch. After experimenting with these high pressures for some time, it was found that about all the gasoline that could be marketed was obtained from pressure not exceeding 300 lb. As a consequence, the pressure used in the majority of gasoline extraction plants to-day range from 250 to 300 lb. per square inch.

"In the compression process of gasoline extraction, the equipment generally used consists of a vacuum pump, two-stage compressor, suitable scrubbers, cooling coils, accumulators, blending tanks and other accessories. Our apparatus is fully described in Bulletin 34-B, which will gladly be sent upon request.

Transportation of Oil

The *California Oil World* gives us this information on oil pipe lines:

"Following the first trial in 1865, the pipe line carriage of oil overland became practically universal, increasing many times the rapidity of deliveries, enlarged the markets and cut the previous high cost of moving oil by rail or wagon, thus bringing closer together the producer and the consumer. Pipe lines of to-day are owned almost wholly by the large marketing companies, a natural development in the oil industry, and for its general welfare and progress could not very well have been different. In California there are about 2,467 miles of main trunk pipe line and 50,000 miles throughout the United States. The oil pipe line from Texas to the refineries at south Chicago travels 2,800 miles. Were the expense incurred in the operation of the lines to fall upon the small producer the cost would be prohibitive. So, under the present working order the marketing concerns take over the transportation problem. The costs involved are taken into consideration in the price offered the producer for his oil.

Public Utility Committee Issues "The Bulletin"

Atlanta, Ga.—The Georgia Committee on Public Utility Information has started the publication of a fortnightly journal which is issued in the interest of, and sent to customers of, gas and electric companies throughout the State, electric railways, and the employees and the investors in these utilities. The publication is known as *The Bulletin*, and among other things will endeavor to build good-will between the general public and the utilities of the State, lack of which is largely responsible in many cases to the difficulties in which such utilities sometimes find themselves. The first issue contains much interesting and valuable information on ways and means of cutting down the gas bills, most of the information having been furnished by the Atlanta Gas Company.

New Apparatus to Take Care of Winter Load

Austin, Texas.—The Gas Machinery Company, of Cleveland, Ohio, have been awarded contract for an eight-foot set of double superheater carbureted water gas apparatus to be installed in the plant of the Austin Gas Light Company, Austin, Texas.

This set will be complete with reverse steam connections, turbo blower, air and steam motors, explosion check valve, pyrometer and charging floor and will be installed in space that has already been provided in the present generating house.

Installation is being made by the gas company in order to take care of the winter load and must continue the high grade of service that the Austin Gas Light Company has furnished in the past.

Petitions for Service Charge

Marlboro, Mass.—The Marlboro-Hudson Gas Company has petitioned the Public Service Commission for authority to establish a service charge. The date for hearing on this petition has not been set. General Manager Robert Jameson said: "The petition involves a revision of the rates. There have been many small consumers who take little or no gas and the cost of serving them causes a burden on the gas company and on the substantial consumers of gas.

"The Legislature passed a new law last year authorizing a service charge price, or in other wards, a two-part rate, one for capacity for service and the other charge for net cubic feet consumed.

"The petition filed was from the Boston office of the gas company and I assume it calls for a $1 charge per meter. The price of gas per thousand cubic feet if this petition filed with the Public Utilities Commissioners is granted will reduce the price of gas over what is now paid.

"But I will say the substantial user of gas will pay less on his monthly bill for gas than he is paying now, and the consumer who uses little or no gas, particularly those who go away for the summer, will be required to pay a charge commensurate with the cost of supplying him with service."

The Gardner Gas, Fuel & Ligmt Company has also filed an application for permission to charge a monthly service rate. It is thought to be only a preliminary start to a proposed reduction in rates.

Middletown Rebuilding Its Gas Plant

After being handicapped for some years by inadequate manufacturing facilities, as well as by insufficient ground space, the Orange County Public Service Corporation of Middletown, N. Y., has abandoned its old gas plant and is entirely rebuilding its plant on a new site, where it will have the benefit of proper railway facilities and space for future expansion.

In order to obtain the best advice and engineering skill in making this important move, the corporation engaged the services of the U. G. I. Contracting Company, of Philadelphia, to design the new plant, including the buildings and awarding to the same company the contract for installing the carbureted water gas apparatus, as well as other machinery and connections required for the plant.

Under the able direction of E. E. Mandeville, president, the Orange County Public Service Corporation is experiencing a rapid and healthy growth.

Has Lowest Rate in Iowa

Burlington, Iowa. — Burlington will start the use of $1.25 gas on the 15th of this month.

At present the rate is $1.48 per 1,000 ft. of gas.

The first noticeable decrease on the bill will be that rendered on Nov. 1, which includes the meter reading from Sept. 15 until Oct. 15, according to a reminder announced recently at the City Hall.

When the $1.25 rate goes into effect in Burlington it will mean the lowest rate in the State of Iowa, and, it is understood, there will be no contest on the part of the Burlington Gas Light Company, although there still exists a possibility of court action, with the gas company as the plaintiff. Recently an extension was granted and this extension terminates with the use of gas at the time of the mid-September reading. After Sept. 15 the consumer will be using gas at the $1.25 rate, the bill to be rendered Nov. 1.

Will Maintain General Office in Aurora

Aurora, Ill.—Although the principal offices of the Western United Gas & Electric Company are to be moved to Lockport as a result of a vote o fthe stockholders, the executive and accounting offices will remain in Aurora, thus providing for the employment here of the same force as is in Aurora now.

The general offices have been moved to Lockport, it is stated, as a part of a general reorganization of the Western United Gas and allied companies whose natural central location is Lockport, where the chief gas producing plant, the Coal Products Company, is located. The principal offices of the Western United, the Coal Products, the Illinois Commercial Mining and the Southern Gas Company will now be in Lockport. The moving of the Western United office has one unfortunate phase. It will result in the city of Aurora losing the taxes on its capital stock, which are now collected by the city, and the east-side school district. The capital stock in the future will be collected by Lockport. The tax collected in Aurora on the capital stock is said to have been about $33,000.

Hearing Postponed

Concord, N. H.—A postponed hearing involving the Manchester Gas Light Company and the People's Gas Lifght Company of Manchester, for consolidation and authority to transfer property to a new company has been set forward to some date in October, by the New Hampshire Public Service Commission. Warren, Howee & Wilson, of Manchester, represent the Manchester company.

A hearing was also held before the commission on a petition of the Boston & Maine Railroad to issue bonds for refunding purposes, amounting to $3,049,000. Judge Harry J. Brown appeared for the railroad.

Files New Rate Schedule

Harrisburg, Pa.—Numerous utilities of the State will increase rates with the close of September, according to new tariffs filed with the Public Service Commission. Among companies filing new rate schedules are the Taylorstown Natural Gas Company, Taylorstown and Claysville, Washington County.

Bureau of Standards Issues Natural Gas Circular

The Bureau of Standards has just issued circular No. 116, entitled "How to Get Better Service with Less Natural Gas in Domestic Gas Appliances."

This circular gives the principal conclusions from the laboratory and field investigations of the Bureau, on the correct use of natural gas in the home. Proper adjustment of appliances will make it possible to get better service with much less gas, and it will allow the gas pressure to be reduced to two ounces or less. Reduction in pressure will greatly reduce the leakage in the distributing systems and this with the saving in the homes will add a large number of years to the period that natural gas will be available for domestic use.

This publication is now ready for distribution and anyone interested may obtain a copy by addressing a request to the Bureau, Washington, D. C., until the free stock is exhausted.

Manager Priest Promises Reduction

Brockton, Mass.—A pledge to Brockton consumers to reduce the price of gas just as soon as the finances of the company will permit and "as much and as often as our operating expenses will permit," is made by Manager George H. Priest, of the Brockton Gas Light Company. No definite date for the first reduction is set, however. He also announces further probable reduction in wages.

"No dividends have been declared since Jan. 1, 1918, and last year's earnings were absorbed in paying off a portion of the company's losses, accumulated during the war period, leaving no balance to be paid out as dividends," Mr. Priest states.

"The company has a floating debt of about $600,000. After the company has been established on a sound financial footing, it will practise a policy which will be to reduce the gas rates just as much and as often as our operating expenses will warrant.

"A reduction in wages to the gas-house employees of 10 per cent went into effect July 17 and affected about 50 to 200 employees working for the company.

"Other wage reductions will be made when local conditions warrant such a step."

Officers were re-elected at the annual meeting of the company as follows: Marcus Beebe, Boston, president; John S. Bartlett, Boston vice-president; M. P. Clough, Boston, treasurer; R. C. Morse, Milton, and A. A. Wilbur, Brockton, assistant treasurers; C. S. Purinton, Plymouth, clerk.

The directors, also re-elected, follow: George H. Priest, Brockton ex-Mayor Stewart B. McLeod Brockton; Henry K. Morrison, Lynn, Marcus Beebe, John S. Bartlett, M. P. Clough, R. C. Morse, C. S. Purinton, B. N. Johnson, Lynn.

Cost of a Strike

The National Alliance of Employers and Employed, of England, has estimated the cost of the British coal strike as follows:

Coal lost, 55,250,000 tons valued at	£70,000,000
Miners' loss in wages	65,000,000
Increased railway subsidy	40,000,000
Coal subsidy	10,000,000
Unemployment insurance loans	30,000,000
Cost of defense and precaution	30,000,000
Loss of revenue-income tax, super-tax, due to trade disturbance	120,000,000
	£365,000,000

Of course, there must be added to the foregoing, the loss to merchants with whom the various people employed by the mines usually bought from and also the factories that closed because they could not get coal.

Rather costly, wasn't it?

It is sincerely hoped that these kind of upheavals may be nipped in the bud and settled amicably by arbitration, and there is no good reason why they cannot be.

The whole thing reverts to a give-and-take affair, where common sense, justice and humanity must predominate.

Buchanan Gas Rate Cut

The Niles Gas Company has reduced its rate in Buchanan from $2 to $1.85 per thousand cubic feet

Defunct Colorado Corporation

The following Colorado corporations are defunct. "In accordance with the provisions of chapter 105, sessions laws of 1919, Carl S. Milliken, secretary of the State of Colorado, has declared the following corporations defunct, and inoperative, and no longer competent to transact business in the State of Colorado. (Seal.) Sept. 1, 1921.":

The Black Canon Fuel Company.
The Caddo Oil & Gas Company.
The Casper Oil Company.
The Deer Park Coal Company.
The Great American Oil Company.
The Green Mountain Coal Company.
The Mid-Continent Oil & Gas Company.
The Mid-Continent Petroleum Company.
The Moapa Oil Company.
The Non-Explosive Appliance & Coal Mining Company.
The Phoenix Coal Mining Company.
The Poudre Oil & Gas Company.
The Scully Oil Development Company.
The United Coal Products Company.

Announces Rate Reduction

Hartford, Conn. — Announcement of the action of the Hartford City Gas Light Company in reducing its rate to customers has led to many inquiries as to whether the Hartford Electric Light Company would effect some reduction of a similar nature, says the Hartford *Courant*. Officers of the latter have been asked frequently within the past few days as to this possibility and have indicated that, while there is every desire to place rates on a lower basis at the first possible opportunity the time has not yet come.

Gas Plant Burns

La Junta, Col.—The blowing out of a valve head in the boiler room of the La Junta (Col.) gas plant was the cause of a fire that entirely destroyed the gas plant of that city.

The own of Swink, Col., the home of the Rockyford cantaloupe was dependent upon this plant for its gas. The plant was owned by Fred A. Sabin and was valued at $8,000, fully covered by insurance.

A temporary plant will be set up at once.

Personal Notes

HUGH S. RIDDELL, for the past eleven years connected with the Greenfield (Mass.) Electric Light & Power Company and for the greater part of that period holding the position of manager, has resigned on account of ill-health. At a meeting of the directors of the company his resignation was accepted with regret. During the time he has been an official of the company Mr. Riddell has rendered highly capable service, and the public will learn of his resignation with the same regret as is felt by the board of directors.

MARTIN M. SPELLMAN, manager of the Westerly (R. I.) Light & Power Company, will not be seen in Westerly for several months because of a nervous breakdown. Mr. Spellman has been granted a leave of absence from his duties at the local office and has gone to a sanatorium in Jamestown for a complete rest. All hope that he will return in the best of health; he will be missed in the community during his absence.

W. S. GUITTEAU, widely known to the gas industry throughout the country, has opened a sales office at 60 Wall Street, New York, for the Stacy Bros. Gas Construction Company, Cincinnati, Ohio. Mr. Guitteau says that the latchstring is on the outside, and that gasmen will always be welcomed, as well as others to whom he can be of service.

R. HOLWORTHY HEATH, of Austin, Tex., has arrived at Corpus Christi to take the management of the Corpus Christi Gas Company, vice A. E. Beach, who has been transferred to Waxahachie to take charge of the Waxahachie Gas Company, owned and operated by the same corporation. Mr. Heath, a native of Corpus Christi, until recently was connected with the Austin Gas Light Company, and is familiar with natural as well as artificial gas.

THE PACIFIC GAS & ELECTRIC COMPANY reports for July a surplus after reserve for depreciation of $364,010, an increase of $74,401 over July, 1920. For the seven months there was a balance after preferred and common dividends of $645,530, an increase of $477,374 compared with the same period of 1920.

Gas from Ventura Field in Prospect

Santa Barbara, Cal.—Development of new gas wells at Ventura may have progressed to a point within the next thirty to sixty days where they may be able to supply Santa Barbara with natural gas before long.

Frank H. Bivens, district superintendent of the Southern Counties Gas Company, made a trip to Ventura recently to look the situation over, and while he reported that there is not a sufficient amount of gas produced there at present to supply this city, new wells are coming in all the time and the outlook is favorable for an adequate supply soon.

There are seventeen wells at Ventura now, producing about 1,500,000 ft. of gas. Of this amount Ventura uses some 600,000 ft., and Mr Bivens estimates that it would require another million and a half feet or so to supply Santa Barbara. It is believed this amount will be forthcoming soon, in view of the rapidity with which new wells are being developed. The new wells would have to demonstrate their ability as producers for some time after coming in, however, before it would be advisable to go to the expense of getting the gas here, according to Mr. Bivens. It would therefore be some months before Santa Barbara would have natural gas even after enough was produced at Ventura to supply both places.

Gas Company Appeals to Commission

Columbus, Ohio.—The Van Wert Gas Light Company, of Van Wert, filed appeal with the Public Utility Commission from an ordinance passed by the city council regulating rates to be charged for gas furnished by the complainant. Hearing was assigned for October 18.

No previous announcement of the intention of the gas company since the council passed its ordinance specifying a lower rate, has been made. W. H. Dailey, attorney for the gas committee of the council, when told of the company's action, said that, of course, the city will present its side of the case at the Utilities Commission hearing. Mr. Dailey was employed several weeks ago to assist City Solicitor T. J. Trippy in handling the matter.

The ordinance passed by the city council July 28 specifies that the gas company shall charge $1.65 gross per thousand cubic feet for gas which tests at least 550 B.t.u. There is to be a discount of 10 cents per thousand for payment of bills by the tenth of the month following service and a minimum charge of 50 cents per month.

It is also specified that the gas company shall provide a calorimeter for testing gas and that there shall be a reduction in rate when the gas fails to test 550 B.t.u.

Tests made here between June 2 and June 11 showed that the gas furnished the city at that time was below the standard specified in the ordinance, the highest test out of several being 476.

Concerning Coal Production

In addressing the Colorado and New Mexico Coal Operators' Association on September 3, Francis Peabody, formerly chairman of the National Defense Committee, in charge of coal, said:

"It will be at least six months, and possibly twelve, before there will be a heavy coal production again. As long as the present industrial conditions exist in the coal industry we cannot hope to return to a normal production basis."

Elkhart Asks Lower Gas Rates

Elkhart, Ind.—The city of Elkhart has filed a petition with the Public Service Commission against the Elkhart Gas & Fuel Company asking for a decrease in rates. The rate for gas now ranges from $1.15 to $1.50 a thousand cubic feet, according to the amount used. The petition also states the commission's valuation of the utility is too high and asks that it be reduced.

The commission denied the Brookville Electric authority to increase rates.

Brockton Gasmen Win Game

Brockton, Mass.—The gas company beat the Woodard & Wright Company 12 to 4, at Nelson's Playground, pounding both Barker and Saline to all parts of the field for fourteen hits. Norman got a home run and the fielding and batting of Triggs and Papineau were features. Burke, the high school "star," pitched a great game and was held up in big-league style by "Pete" Heath.